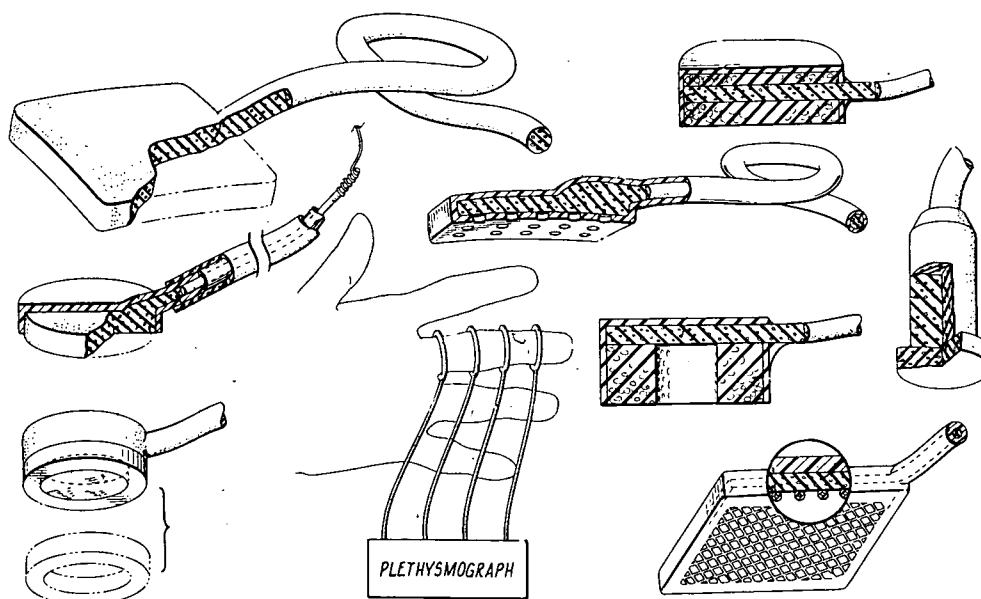


NASA TECH BRIEF



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Ultra-Flexible Biomedical Electrodes and Wires



The problem:

To develop a very flexible, uniformly conductive, comfortable, and easily applied biomedical electrode that conforms to the body contour during body motion.

The solution:

A soft, flexible electrode fabricated from an elastomer impregnated with a conductive powder which can be configured into any required shape, including a wire shape to connect the electrode directly to an electrical instrument or to a conventional metallic wire.

How it's done:

As shown in the figure, the device consists of the electrode and a conductor, both formed of silicone

rubber as the elastomer and loaded with silver-plated particles as the conductive material. The electrode can be molded or cut to fit over any irregular body contours and to accommodate body location and type of measurement. A wide variety of electrode configurations can be fabricated using accessory materials such as silicone rubber sponge, silicone rubber adhesives, or adhesive bandages. Electrodes and "wires" made of the impregnated elastomeric material are suitable for implantation and connection to implanted telemetry equipment. The impregnated elastomeric wire is not only flexible but stretchable, in some cases up to 40% of its length, while maintaining excellent conductivity. This is a significant improvement over the normal metallic lead wires, which always present the danger of breaking at the junction

(continued overleaf)

with the electrode. Where external electrodes are used, improved contact with the skin can be obtained with sodium chloride electrolyte paste or jelly. In this case, the electrode can be designed with wells in which the electrolyte is placed. It is not always necessary to use an electrolyte paste, since the electrode moves with the skin. Long-term monitoring of relatively motionless bed-ridden patients can be accomplished with the electrode alone. Use of the electrode without the wet electrolyte avoids the problem of periodic replenishment and the discomfort of a continuously damp interface with the skin. The dry electrode does result in a higher impedance, but this is readily handled with a high input-impedance amplifier. Previous studies with electrodes have shown that silver-silver chloride provides the lowest galvanic potential when used with a sodium chloride jelly. The chloride ions provide the mechanism by which the biopotentials are sensed. A layer of silver-silver chloride can be plated on the elastomeric electrode surface by conventional

electroplating using a 10% HCl solution with silver wire as a cathode and a 6-V power source. Plating on the electrode does not alter its flexibility. Insulation can be provided on any part of the electrode by spraying, dipping or brushing with nonconductive silicone rubber.

Note:

Requests for further information may be directed to:
Technology Utilization Officer
Ames Research Center
Moffett Field, California 94035
Reference: TSP70-10420

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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